



Research Article

Relationship Between Physical Activity Level and Cardiovascular Risk Factors among Teachers

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Abstract

Background and Objective: Cardiovascular disease is one of the most leading cause of death in worldwide and also in Malaysia. Every sorts of measure have been taken to reduce the cases. Physical activity is an important constituent of cardiovascular health. Physical activity is also associated with a substantial number of cognitive and academic benefits, therefore school teachers can set an example in promoting a physically-active lifestyle in school children. The aim of this study was to examine the levels of physical activity (PA) and its association with cardiovascular risk factors in a sample of school teachers in Kuala Lumpur. About 74 teachers from primary and secondary schools were recruited. **Materials and Methods:** The PA level was determined using long version. Anthropometric measurements and blood samples were collected to determine cardiovascular risk factors. **Results:** The results showed that the school teachers recorded an overall mean (\pm SD) of 2344.93.2396.583 MET-min/week which showed that the PA level was moderate. About 25.0% of the sample had low physical activity, 46.9% were moderate and 28.1% were considered as high physical activity level. For Body Mass Index (BMI), 39.2% of teachers were categorized as overweight and 35.1% as obese ($>24 \text{ kg m}^{-2}$). One way ANOVA test showed significant mean difference of total cholesterol between age group ($p < 0.05$) and t-test showed mean difference of systolic blood pressure ($p < 0.001$), waist circumference ($p < 0.001$) and glucose level ($p = 0.002$) gender. Mean while there was significant mean difference of physical activity level between type of school ($p < 0.05$). However, PA level showed no significant correlation with cardiovascular risk factors ($p > 0.05$). **Conclusion:** There were no significant correlation between PA level and cardiovascular risk factors. Overall, the PA levels of school teachers need to be improved. Interventions aimed to encouraging PA among the teachers in the future.

Key words: Systolic and diastolic blood pressure, cardiovascular risk factor, school teachers, physical activity, total cholesterol

Citation: Zuraini Zulkepli, Nur Zakiah Mohd Saat, Nor Farah Mohammad Fauzi, Siti Aishah Hanawi and Noraziah Md Zin, 2019. Relationship between physical activity level and cardiovascular risk factors among teachers. Asian J. Epidemiol., CC: CC-CC.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Non-communicable Diseases (NCDs) nowadays is very significant and is a global public health problem that is increasing and affecting all countries, regardless of income¹. According to the World Health Organization (WHO)², NCDs are mostly chronic diseases that cannot be transmitted from one person to another. Report from National Health and Morbidity Survey 2015 (NHMS) have shown the prevalence of risk factors for cardiovascular disease (CVD) in 2015 in Malaysia. There were an increase in CVD risk factors in that year compared to the study in 2011, especially in diabetes and hypercholesterolemia³.

Previous studies have shown that physical activity has a protective effect of CVD morbidity and cause of death⁴⁻⁶. Physical activity involves all body movements using a lot of muscle and energy in everyday life such as work, chores, recreational, exercise and play sports^{7,8}. According to American guidelines of physical activity (2008), an individual must do two types of physical activity each week to improve the health of aerobic and muscle strength that is by doing aerobic activity moderate intensity such as brisk walking every week and activities strengthen the muscles of 2 or more days a week which involves all the muscles of the major such as the legs, hips, back, abdomen, chest, shoulders and hands⁹.

Based on the research conducted, by doing moderate intensity physical activity for 60 min a week (240 metabolic equivalent (MET) min or 4 MET h) or on foot and doing moderate intensity physical activity is proven to show a reduction in risk is comparable to the energy consumption of activities heavy intensity physical in which it was reported to reduce the risk of CVD and diabetes¹⁰.

Lack of physical activity level has increased in many countries with major implications for the prevalence of NCDs and public health in the world's population⁷. The level of physical activity is very significant where it is closely related to ethnicity, gender, age, occupation and education level¹¹. Furthermore, the Malaysian government is also actively promoting a campaign to cultivate healthy lifestyles through physical activity among Malaysians, especially the youth and also aims to raise awareness and increase the interest of youth for active life¹².

In addition, various occupations have studied the physical activity levels but very limited study conducted on primary school teachers. Past studies that have been conducted on secondary school teachers elected in Nigeria shows the level of physical activity of the population of participants that low was 4.3%, while the population showing the level of moderate physical activity was 29.1 and 66.7% showed a high activity

level¹³. A study on nutrition survey among population in Malaysia indicated that between demographic factors there was difference in physical activity level of sedentary. For example women has higher percentage of sedentary level which is 43% compared to men¹⁴ which is 10%.

Even though, there was previous study on PA and CVD risk factors, however it didn't emphasis on the type of job and using different instrument for PA¹⁵. In order to fill this gap, this study was done due to previous findings as the largest group of educators, teachers play an important role in educating students to change to a healthier lifestyle. Furthermore, teachers also need to be a model that can serve as an example in living an active lifestyle to students. Therefore, this study want to determine the relationship between CVD risk factors and the level of physical activity among primary and secondary school teachers in Kuala Lumpur.

MATERIALS AND METHODS

Study design and sampling: This cross-sectional study was carried out on a sample of school teachers aged 18-60 years old in 6 schools in Kuala Lumpur. The subject who participated were voluntary but excluded those adults who were disable or use walking assisting device, pregnant and has history of CVD risk factors. This study was done between November, 2016 until April, 2017

Demographic data: This section was self-administered. The questionnaires comprised questions on age, gender, ethnicity, contact information, type of schools, marital status, smoking status and health problems.

Anthropometric data: Subject's body height was measured using measurement device (SECA 206) to a precision of 0.5 cm. Body weight was measured by electronic weighing device (Omron Karada Scale) to a precision of 0.1 kg. Waist circumference was measured at the lower margin of the last palpable rib in midaxillary line and the highest point of iliac crest at minimal respiration to the nearest 0.5 cm at the end of normal expiration. Body mass index (BMI) was then calculated as weight in kilograms divided by height squared in meters (kg m^{-2}) and categorized according to Asian cut-offs points as underweight ($<18.5 \text{ kg m}^{-2}$), normal ($18.5-22.9 \text{ kg m}^{-2}$), overweight ($23.0-27.49 \text{ kg m}^{-2}$) or obese ($\geq 27.5 \text{ kg m}^{-2}$)¹⁶.

Biochemical measurements: Blood pressure, blood glucose and blood cholesterol were measured, respectively after the anthropometric data was taken. Blood Pressure (BP) of subject

was measured using digital monitor (Omron Inc.) with the subjects rested and seated. Blood pressure was measured with the subject in the sitting position and the arm placed at the same level as the heart. Hypertension was defined as either elevated systolic BP or diastolic BP alone or the combination of both. Easy touch glucose meter was used to measure random blood glucose and the classification of normal (3.9- 5.5 mmol L⁻¹) was based on American Association for Clinical Chemistry¹⁷. Easy touch cholesterol meter was used to measure random blood cholesterol and the normal cholesterol range in subject¹⁸ was <5.2 mmol L⁻¹.

Physical activity assessment: Physical activity was assessed using the long form of International Physical Activity Questionnaire (IPAQ) through interview session. The questionnaire had been validated and tested for its reliability among a Malay population in Malaysia by other researcher. This instrument composed of 5 sections which consist on the physical activity during the last 7 days. Information for the length of time (the number of sessions and average time per session) spent on walking, moderate or vigorous-intensity physical activities, on both week days and weekends was obtained using this questionnaire. The physical activity score was expressed using the following formula:

$$\text{MET-min/week} = \text{MET level} \times \text{min of activity/day} \times \text{day per week}$$

The physical activity level (PAL) of subject was categorized into low (<600 MET-min/week), moderate (600-3000 MET-min/week) and high (\geq 3000 MET-min/week) according to the guidelines of IPAQ (2005)^{19,20}.

RESULTS

About 74 subjects participated in this study. Table 1 showed the distribution of socio demographic of teachers where 43.2% of teachers participate were aged between 25 and 35 years and the majority of the subjects were female teachers (77%) and 95.9% were Malays. A total of 82.4% of teachers were married and most of them do not smoke (94.6%). Whereas, the working hour per day for most teachers were 8 h (58.1%).

Result in Table 2 showed the distribution of CVD risk factors in school teachers in Kuala Lumpur. For BMI, 39.2% of teachers were indicated as overweight and 35.1% were obese and overall mean showed most of them were overweight (26.444-5.2596). About 56.8% of teachers were obese because the WC exceeded the normal range which is more than 80 cm and also indicated obesity among the teachers with overall

Table 1: Socio-demographic characteristics of school teachers (n = 74)

Characteristics	n	(%)
Age groups		
25-35	32	43.2
36-45	29	39.2
46-55	13	17.6
Gender		
Men	17	23.0
Women	57	77.0
Ethnics		
Malay	71	95.9
Chinese	1	1.4
Indian	1	1.4
Others	1	1.4
Marital status		
Single	13	17.6
Married	61	82.4
Smoking status		
Yes	4	5.4
No	70	94.6
Working (h)/day		
5	1	1.4
6	6	8.1
7	9	12.2
8	43	58.1
9	9	12.2
>10	6	8.1

Table 2: Distribution of CVD risk factors in school teachers (n = 74)

CVD risk factors	n	%	Mean \pm SD
BMI (kg m⁻²)			
Underweight	2	2.7	26.444 \pm 5.259
Normal	17	23.0	
Overweight	29	39.2	
Obese	26	35.1	
WC (cm)			
Normal (\leq 80 cm)	32	43.2	83.764 \pm 11.599
Obese (>80 cm)	42	56.8	
Systolic blood pressure (mm Hg)			
Normal	59	79.7	107.800 \pm 15.529
Prehypertension	13	17.6	
Hypertension stage I	1	1.4	
Hypertension stage II	1	1.4	
Diastolic blood pressure (mm Hg)			
Normal	56	75.7	73.920 \pm 9.484
Prehypertension	12	16.2	
Hypertension stage I	5	6.8	
Hypertension stage II	1	1.4	
Glucose level (mmol L⁻¹)			
Normal	67	90.5	4.9090 \pm 0.793
Prediabetes	6	8.1	
Diabetes	1	1.4	
Total cholesterol level (mmol L⁻¹)			
Normal	26	35.1	5.478 \pm 1.077
Borderline high	29	39.2	
High	19	25.7	

mean of 83.764.11.5999. Systolic blood pressure showed as many as 79.7% were normal and 17.6% were pre-hypertension and overall mean showed that they were in normal range (107.80-15.529). Similarly, diastolic blood pressure also

Table 3: Mean difference between CVD risk factors with age group

CVD risk factors	Mean \pm SD			f-value	p-value
	25-35 (n = 32)	36-45 (n = 29)	46-55 (n = 13)		
BMI (kg m ⁻²)	26.016 \pm 5.9386	26.684 \pm 3.9254	25.758 \pm 4.0969	0.212	0.809
WC (cm)	82.881 \pm 12.6545	83.200 \pm 10.0536	84.662 \pm 8.8740	0.122	0.886
SBP (mm Hg)	105.420 \pm 12.993	106.860 \pm 14.179	108.410 \pm 10.250	0.260	0.772
DBP (mm Hg)	71.810 \pm 8.9140	74.930 \pm 8.2980	74.080 \pm 7.2390	1.092	0.341
Glucose level (mmol L ⁻¹)	4.808 \pm 0.4466	4.696 \pm 0.5605	5.015 \pm 0.2734	2.054	0.136
Total cholesterol level (mmol L ⁻¹)	5.184 \pm 1.1824	5.490 \pm 1.0203	6.177 \pm 0.5102	4.279*	0.018

*Mean difference is significant at 0.05 level

Table 4: Mean difference between CVD risk factors with gender

CVD risk factors	Mean \pm SD		t-value	p-value
	Men (n = 17)	Women (n = 57)		
BMI (kg m ⁻²)	27.425 \pm 5.3708	25.877 \pm 4.7123	1.151	0.253
WC (cm)	92.759 \pm 10.3802	80.503 \pm 9.5230	4.563*	<0.001
SBP (mm/Hg)	115.820 \pm 13.473	103.730 \pm 11.490	3.659*	<0.001
DBP (mm/Hg)	75.180 \pm 9.3420	72.910 \pm 8.1400	0.973	0.334
Glucose level (mmol L ⁻¹)	5.104 \pm 0.3644	4.710 \pm 0.4751	3.145*	0.002
Total cholesterol (mmol L ⁻¹)	5.794 \pm 1.2487	5.384 \pm 1.0140	1.385	0.170

*Mean difference is significant at 0.05 level

Table 5: Physical activity status based on IPAQ (n = 64)

Parameters	N	%	Mean \pm SD
Physical activity level			-
Low	16	25.0	-
Medium	30	46.9	-
High	18	28.1	-
Domain of physical activity (MET-min/week)			
Occupation	-	-	1478.880 \pm 861.84
Transport	-	-	277.093 \pm 115.24
Housework	-	-	1297.293 \pm 720.91
Leisure time	-	-	1124.074 \pm 648.42
Total physical activity level (MET-min/week)	-	-	2396.583 \pm 2344.93
MVPA-Leisure time (MET-min/week)	-	-	185.427 \pm 64.30

showed as many as 75.7% were normal and 16.2% were pre-hypertension and overall mean of 73.92-9.484. For fasting glucose levels, a total of 90.5% of teachers were normal and 8.1% was with pre-diabetes with overall mean of 4.909-0.7937 which in normal range. A total of 35.1% of teachers had normal total cholesterol and 39.2% were on borderline with overall mean of 5.478-1.0773 which their total cholesterol showed borderline high.

According to Table 3, comparing the mean difference of CVD risk factors between age group. There was no significant difference of BMI, waist circumference (WC), systolic and diastolic blood pressure (SBP and DBP), blood glucose levels between age group. However, the level of total cholesterol showed a significant difference between age group ($p = 0.018$). The *post hoc* test as done for total cholesterol between age group and showed that there was significant mean difference between the age group of 25-35 years old and 46-55 years old (mean difference = -0.9925) ($p = 0.014$).

Furthermore, Table 4 showed that there was a significant difference in WC ($p < 0.001$), systolic blood pressure (SBP) ($p < 0.001$) and glucose levels ($p = 0.002$) between gender. The mean WC was significantly higher among men. Meanwhile the mean SBP was significantly higher among men compare to women. In this study the result indicated that the mean glucose was slightly higher among men compare to women significantly.

Meanwhile, Table 5 showed the percentage of physical activity levels (PAL) by low, medium and high category. A total of 30 teachers showed medium level of physical activity of 46.9% followed by 18 teachers showed high level of physical activity, which accounted for 28.1% and 16 teachers showed that low level of physical activity, which accounted for 25.0%. The overall mean for total physical activity level (PAL) was 2396.583 \pm 2344.93 which showed moderate level of physical activity. For the moderate-vigorous physical activity (MVPA) in leisure time, the teachers showed the overall mean of 185.427 \pm 64.30 MET-min/week which definitely did

Table 6: Mean difference between PAL with age group, gender and type of school

Factors	Physical activity level (PAL)						
	n	Mean	Median	IQR	H/U	Z	p-value
Gender							
Men	15	3637.80	1966.50	5858	273	-1.498	0.134
Women	49	1949.16	1146.00	2100			
Age groups							
25-35	28	3091.59	2310.75	4101	4.143	2	0.126
36-45	25	1727.70	894.60	1867			
46-55	11	1847.14	868.50	1891			
Type of school							
Primary	29	1803.45	1146.00	2111	364	-1.935	0.053
Secondary	35	2793.59	1712.00	4319			

Table 7: Correlation between CVD risk factors and physical activity level (n = 64)

Factors	Leisure time		Total physical activity level		MVPA-Leisure time	
	r	p-value	r	p-value	r	p-value
BMI	0.062	0.627	0.086	0.499	0.064	0.614
WC	0.152	0.231	0.110	0.386	0.148	0.242
SBP	0.210	0.096	0.126	0.322	0.165	0.192
DBP	-0.002	0.988	-0.071	0.577	0.047	0.710
Glucose level	-0.043	0.733	0.026	0.840	0.035	0.783
Total cholesterol	-0.063	0.620	-0.087	0.493	-0.006	0.964

r = Correlation coefficient, *Correlation is significant at 0.05 level

not reached 150 min per week as suggested. By physical activity domain distribution, most of the subjects spent overall mean of 1478.880 ± 861.84 MET-min/week for occupation followed by house work, leisure and transport.

Moreover, Table 6 indicated the physical activity level had no significant difference in age group, $H(2) = 4.143$ ($p > 0.05$). Based on this analysis, there was no significant median difference of physical activity levels among teachers by gender, age group and type of school.

Furthermore, Table 7 indicated the association between CVD risk factors and physical activity level (domain, total physical activity level and MVPA-leisure time). There was positive correlation between leisure time with BMI, WC and SBP. Meanwhile there was negative correlation between leisure time glucose level and total cholesterol ($p > 0.05$). On the other hand there was positive correlation between total physical activity with BMI, WC, SBP and glucose level ($p > 0.05$).

DISCUSSION

The prevalence of overweight and obesity in the teachers in the present study is far above the prevalence reported in adults in the 2015 National Health and Morbidity Survey (NHMS), where the national prevalence of overweight and obesity was 33.4 and 30.6%, respectively. As is also evident

from national data³, waist circumference measures, indicative of central adiposity showed that 48.6% had a waist circumference in the risk range as compare to the present study. With the high prevalence of obesity and the added risk of central adiposity, it could be argued that both primary and secondary teachers in the study have a higher risk of developing NCDs than the general population. As for systolic and diastolic blood pressure and fasting blood glucose in this study are shown normal which was opposite³ that showed prevalence of undiagnosed of hypertension was 17.2% and the prevalence of undiagnosed blood glucose was 9.2%. Meanwhile, the prevalence for undiagnosed hypercholesterolemia was reported 38.6% which is opposite to the present study that is in borderline high.

Results in this study indicated that women and older age group mostly in medium levels of physical activity. Similar finding also showed by previous study in Korea that the percentage of the physical activity levels in the population in which the moderate level of physical activity was 45.6%, followed by high activity levels of 34.2% and a low activity level²¹ is 20.2%. The results parallel with previous study by Cheah and Poh²², where male compare to female and older age group was physically active. Previous study in Malaysia among young adult, middle adult and elderly indicated that there are many barriers that contribute to the low physical

activity. The barriers can be classified into personal, social environment and physical environment. Most of the young and middle age adult the barriers was personal and physical environment. This is due to the lack of support from family member, friends and facility such as gymnasium. Therefore teachers should get motivation from peer group to increase their physical activity to an active level of physical activity²³.

In this study the mean BMI, WC, SBP, DBP, glucose, total cholesterol were higher in men compare to women. This is parallel with previous study among Malay in Malaysia where men were significantly have higher WC, SBP, DBP and total cholesterol compared to women²⁴. Comparing this study with the subjects in Iran adults, the results indicated the percentage of developing pre-hypertension and hypertension were lower compare to Iranian which 26.6% was estimated to develop hypertension²⁵.

A study in Turkey also showed that 51.9% of the subjects had a moderate level of physical activity, 39.5% were low physical activity level and 8.5% showed high levels of physical activity²⁶. This finding differed from previous study reported the prevalence rate in 8 countries showed a high level of physical activity was from 21-63%, of which more than half of the adult population shows a high level of physical activity²⁷. Meanwhile, the prevalence of low levels of physical activity was from 9-43%. Although, the physical activity level was reported as low in adults by WHO in globally but in this study showed that the level of physical activity was medium. According to previous findings, stated that most teachers move around or walk when teaching sessions take place²⁸. This can be supported by their findings show that individual taking the time to sit longer per day was reported to had lower physical activity levels than individual with less time to sit down. Exercise were recommended for the teachers to improve the level of physical activity and reduce the risk of CVD among obese group²⁹. Previous study indicated that steps per day increase significantly among university employee that walks and using public transport to work instead of driving a cars. Therefore teachers are recommend to use public transport to work rather than drove to work³⁰.

In this study the total cholesterol level increase with increase of age. This is consistent with other findings showed that the average triglyceride and cholesterol levels are significant in the age group of 45-54 and 55-64 age group compared to <25 years. Other previous studies that also showed an increase in the prevalence of diabetes, hypertension, dyslipidemia and obesity with age³¹. This shows an increase in the trend of risk factors of CVD with age. This is parallel with prevalence study in Malaysia indicated that the

risk of developing NCD was higher in rural population with prevalence of diabetes (6.4%), hypertension (30%), impaired fasting glucose 13.9% and obesity³² 44%.

According to the Global Status Report on NCD by WHO, obesity is one of the four key metabolic/psychological changes that occur in response to an unhealthy lifestyle. The other three changes are raised blood pressure, hyperglycemia and hyperlipidaemia, with overweight and obesity being possible risks for these three metabolic/physiological changes²⁷. It is thus not surprising that hypertension, high blood cholesterol and high glucose levels were found in this sample of teachers where in this study, the primary school teachers showed high risk to develop diabetes³³.

The results from this study indicate that mean of waist circumference (WC), systolic blood pressure, diastolic blood pressure and glucose level were higher among male compare to female. Other study showed the opposite result where women have overall mean of waist circumference, HDL-C and triglycerides were higher than men while the mean of systolic and diastolic blood pressure, LDL-C and glucose levels were higher in men than women³⁴. According to Selvarajah *et al.*³², women are more likely to suffer from a number of CVD risk factors in most age groups, especially in housewives³². About 30% of men and 70% of women have prediabetes¹. The results of this study was supported by study in Selangor indicates that percentage of women that obese and overweight were higher compare to men³⁵. Other study Ghazali *et al.*³⁶ showed that in women, older age, less educated and housewives tend to get more than 3 CVD risk factors.

CONCLUSION

In this study, most teachers in Kuala Lumpur is categorized as moderate physical activity levels based on regular physical activity and no significant relationship can be attributed among CVD risk factors on the level of physical activity. Accordingly, to promote physical activity among teachers, intervention programme is an effective strategy to improve the knowledge, understanding and awareness to achieve an active life as envisioned by the Ministry of Health.

SIGNIFICANCE STATEMENT

Malaysia is one of the highest prevalence of obesity among adults in Southeast Asian country. Obesity has an association with CVD. Therefore one of the way to reduce

prevalence of CVD is by physical activity. Teachers is a role model for a student and can motivate them to reduce the risk of CVD by having active lifestyle in the future. The results from this study was hope to increase the awareness among adults to have active life and prevent from having sedentary lifestyle as it can lead to the higher risk of CVD.

ACKNOWLEDGMENT

The authors wished to thank Ministry of Education Malaysia and school principal and CRIM, Universiti Kebangsaan Malaysia for the support in this study.

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